

and Loch Benachally the town of Blairgowrie. The results obtained by the Lake Survey must be of particular interest to these municipalities, as indicating the capacities and the depths of the lochs from which they draw their water-supplies. Lochs Daimh, Kennard, Turret, and Fender, though small lochs, are interesting on account of their relatively great depth. The little Loch Fender, which has an area of only some 22 acres, is especially striking in this respect.

Temperature observations were made at the time of sounding most of the lochs, and the results are given under each loch. In the case of Loch Rannoch, the observations extended over a period of four months, and gave some interesting results as to the march of temperature throughout the waters of the loch from March to July, 1902, but usually the observations are too few to afford material for discussion, though they are available for comparison with any future observations.

The bathymetrical maps illustrating the papers are a distinctive feature, and are excellent examples of chromolithographic work. They are reduced from the Ordnance Survey charts to the uniform scale of 3 inches to the mile. The water-surfaces are tinted in deepening shades of blue, the darkest shades indicating the greatest depths. The land-surfaces are tinted in deepening shades of brown, the darkest shades indicating the highest elevations. Longitudinal and cross sections of the principal lochs are given, the true vertical relief drawn to scale being shown in solid black, while coloured extensions in outline represent the vertical scale exaggerated five times in order to show the relative depth with greater effect. Besides the maps there are numerous woodcuts in the text, some of which are reproduced in this notice.

Appended to the concluding paper are some valuable notes on the geology of the Tay basin, by Drs. Peach and Horne, illustrated by an admirable geological map, and on the biology of the lochs of the Tay basin, by Mr. James Murray, assistant zoologist on the staff of the Lake Survey.

In their concise sketch of the geology and glaciation of the district, Drs. Peach and Horne show that the Tay basin is geologically divided into two parts by the great fault along the Highland border—to the north-west metamorphic rocks pierced by igneous intrusions, to the south-east rocks of Old Red Sandstone age with a small patch of Carboniferous strata. Most of the lochs lie to the north-west of the Highland fault, and the groups of strata are enumerated in the order in which they are met with on proceeding northwards from the fault, their distribution being indicated, and the system of north-east and south-west dislocations which traverse the metamorphic area discussed. After dealing with the lower and upper divisions of the Old Red Sandstone, which occur to the south-east of the border fault, the authors proceed to consider the evidence relating to the glaciation of the Tay basin, which leads to the conclusion that, during the climax of the Ice age, the region must have been covered with one continuous sheet of ice; striae have been found up to elevations of 3000 feet, showing that the highest mountains were over-ridden by the ice, the movement of which must to some extent have been independent of the existing valley-system. This stage was followed by a period of confluent glaciers, when the ice streamed over passes connecting adjoining valleys, leaving in its track lines of moraines. Finally, there was the phase of corrie-glaciers, when the glacial detritus was borne for no great distance from the local centres of dispersion.

The majority of the lochs within the Tay basin, most of them small and comparatively shallow, lie in the midst of drift deposits; several other lochs, some of considerable size, lie along lines of displacement, for example, Lochs Erich, Garry, Laidon, and Lyon, the long axes of which coincide with the courses of more or less powerful dislocations. As typical examples of rock-basins eroded by ice-action, Lochs Rannoch, Tummel, Earn, Iubhair and Dochart are cited. The two last-mentioned originally formed one sheet of water, and have been separated by alluvial material brought down by the river; Loch Dochart is being rapidly silted up, and must formerly have extended three miles up the valley. Further up Glen Dochart a strip of alluvium five miles in length may probably represent a silted-up rock-basin. Loch Tay presents certain features differentiating it from the rock-basins cited, there being no rocky barrier close to the

lake, and the Loch Tay fault runs along the course of the lake for a distance of $5\frac{1}{2}$ miles, the deepest part of the basin coinciding with this fault, to which the deflection of the original valley of the Tay must be due. Thus Loch Tay cannot be regarded as a typical example of a rock-basin, but the other rock-basins referred to seem to furnish strong evidence in support of the theory of ice-erosion.

Tow-net collections were taken in most of the lochs in the Tay basin, and have furnished Mr. Murray with material for some interesting notes on the plankton of the open water of the different lochs. The number of species is not very great, and does not vary much; each loch has a distinct character, which, notwithstanding a considerable amount of seasonal variation, is pretty constant. The genera and species usually met with in the open water of the lakes are enumerated, and although all the forms may be present in most of the lakes, the varying proportions in which they occur give rise to great differences in the character of the plankton. This lacustrine type of plankton was found even in the smallest lochs surveyed. Some of the forms are subject to considerable variation, and sometimes a single organism, usually vegetable, will so increase in a loch as to form a "Wasserblut." A brief account of the plankton-organisms observed in some fifty of the lochs visited is given.

THE HOPE REPORTS.¹

THE fourth volume of the "Hope Reports" contains twenty papers bearing upon the study of insects in particular and the theory of natural selection in general. The most important of these is Mr. Shelford's paper on mimetic insects and spiders from Borneo and Singapore.

So long as we had only a few isolated cases of mimetic resemblance between animals belonging to different families or orders, it was possible for the opponents of the theory of natural selection to make light of them or to urge with some force the argument of the influence of similar external conditions, but as the number increases the difficulty of accounting for these wonderful mimetic resemblances by any other theory than that of natural selection becomes insurmountable. Mr. Shelford's list of mimics and their models is a long one, and as his description is accompanied by valuable field notes and is illustrated by five excellent coloured plates, it forms one of the most important contributions to the literature of the subject which has yet been published. The figures were drawn from the dried specimens as they arrived in this country, and in some cases the mimicry does not seem to be a very close one as it may be judged by the illustrations only, but it is in these cases that the value of the field notes lies.

In the description of a fly belonging to the genus *Sepedon* that mimics a hymenopteran (*Collyris emarginata*, MacL.), Mr. Shelford says:—

"Both of the species now under discussion were caught together on the wing on Mt. Serambu, Sarawak, and when seen alive and actively moving about were not readily distinguishable. As cabinet specimens they furnish an instance of the importance of field-work in the study of mimicry, and of the unreliability of dead impaled insects or mere figures unless, indeed, both are prepared with reference to careful observations of the living forms. The fly when alive was of a very brilliant blue like that of the *Collyris*; but the colour has now faded to a dusky indigo, while the abdomen being much shrunk detracts considerably from the previous resemblance. The legs are brilliant red, and constituted one of the most conspicuous features of both fly and beetle."

The tables that Mr. Shelford gives of the arrangement of these insects which mimic and are mimicked into convergent groups should be carefully studied by naturalists who may have the opportunity to study insects in the tropics.

An important series of experiments on the colour relation between lepidopterous larvæ and their surroundings is described by Prof. Poulton. In *Gastropacha quercifolia* the susceptibility to the colour surroundings appears to be restricted to the younger stages of the larva, but in further experiments Prof. Poulton found that in *Amphidasis betularia* every stage except the first and the fifth or sixth is

¹ "The Hope Reports." Vol. iv., 1900-1903. (Printed for Private Circulation.)

sensitive. These striking differences in the sensitiveness of two caterpillars to the colour of their environment are highly suggestive, and we may hope that these interesting results will be followed by further investigation on the same lines. The paper is illustrated by some beautiful coloured plates of the effects of lichen and variously coloured bark upon the colour patterns of the caterpillars.

Of the other papers in the volume, attention may be directed to Mr. Guy Marshall's interesting essay on conscious protective resemblance, and to Dr. Dixey's account of the Lepidoptera of the White Nile with some excellent cases of seasonal dimorphism in which the cryptic colour is pronounced in the dry season form.

Mr. Annandale gives a remarkable account of the mantis of the Malay Peninsula that resembles the blossom of a *Melastoma*, and Prof. Poulton records the capture of a swarm of *Hypolimnas misippus* on a ship 500 miles from the nearest land.

It is quite impossible to do justice in a short notice to the many interesting features of this volume, but enough has been said to show that the activity of the workers in connection with the Hope Department of the Oxford Museum continues, and that the results obtained are of striking value, not only to the specialist in entomology, but to the great body of naturalists in general who have at heart the important problems of the theory of evolution.

S. J. H.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—An exhibition of 50l. a year, tenable for two years, is offered by the governing body of Emmanuel College to an advanced student, commencing residence at the college in October, 1904. Applications should be sent to the Master of Emmanuel not later than October 1.

MR. CARNEGIE has given 10,000l. to Kenyon College to endow a professorship of economics.

PROF. T. G. BONNEY, F.R.S., will deliver during May, at University College, two lectures in advanced geology on the subject, lessons from geological mistakes:—(1) about rocks; (2) about ice action.

CARDIFF University College has received an additional donation of 5500l. from the Drapers' Company towards its building fund. The company has already contributed 10,000l. for this purpose.

DR. F. H. NEWMAN has been appointed educational adviser to the Durham County Council, and Mr. Hugh Ramage, of St. John's College, Cambridge, has succeeded him in the office of director of higher education for the City of Norwich.

AN interesting feature of the appeal issued on behalf of the fund for providing new and adequate buildings for the University College of North Wales is the liberal response which has been made by old students of the college, the amount already subscribed or promised from this source being no less than 1313l.

THE second volume of the report, for the year 1902, of the U.S. Commissioner of Education has reached us from Washington. This part of the report is devoted largely to statistics, from which it is easy to arrive at the exact state of each grade of education in the United States. We notice under the information given respecting universities, colleges and technological schools that the total amount of benefactions reported during 1902 by the several institutions for higher education amounted to 3,408,000l., of which upwards of 2,500,000l. was received by thirty-one universities and colleges of university standing benefiting to the extent of 20,000l. or more.

At a special meeting of the general council of the University of Glasgow held yesterday Lord Kelvin was unanimously elected to the Chancellorship. Tuesday, April 19, will be observed as commemoration day at the university. In the morning an oration will be delivered by Sir William Ramsay, K.C.B., on "Professor Joseph Black, M.D., of the University of Glasgow (1756 to 1766)," the

enunciator of the doctrine of latent heat; and honorary degrees will be conferred. In the afternoon the medallion of the late Prof. John Young, M.D., will be unveiled in the Hunterian Museum. At a university banquet to be held in the evening Sir William Ramsay will be entertained as the guest of the evening.

A CORRESPONDENT of the *Times* states that the Secretary of State for India has sanctioned the decision of the Government of India to establish an agricultural research station, with an experimental farm and an agricultural college, at Pusa, in the Darbhanga district of Bengal, and to devote to the purpose the donation of 30,000l. entrusted to the Viceroy by Mr. Henry Phipps for some object of public utility, preferably for scientific research. The farm is to serve as a model for similar institutions under provincial Governments, some of the existing institutions being in need of improvement. Lines of experiment are to be initiated and tested before being recommended for trial under local conditions on the provincial farms; seed of improved varieties will be grown for distribution in the different provinces; results reported from other farms will be tested; scientific research work will be carried on; and practical training will be given to students at the college, which is to be known as the Imperial Agricultural College. The students' course will be one of five years, and it will be open to young men from all parts of India. Mr. Bernard Coventry, manager of the Dalsingh Serai estate, has been appointed principal, and enters upon his new duties forthwith, but the college will not be ready to receive students until August or September of next year.

THE third annual general report of the Department of Agriculture and Technical Instruction for Ireland serves admirably to show the great improvement in scientific education in Ireland since the transfer of the administration of the Science and Art Vote from South Kensington to Dublin in 1901. Many instances of this improvement could be given from this report for 1902-3, but one will suffice to show the extent of the activity of the new Irish department. With the aid of direct grants from the department out of the Science and Art Vote, and of indirect grants out of the department's endowment through technical instruction committees, 184 secondary school laboratories, involving an expenditure of, approximately, 35,000l., have been fitted and equipped within two years. When it is remembered that in April, 1901, there were but six science laboratories in secondary schools in Ireland, and that there are now 190 laboratories, with provision for 3500 students working simultaneously, the rapidity with which the department's programme has been adopted will be understood. Laboratories are now recognised in Ireland as an essential part of secondary school provision just as much as desks, blackboards and maps.

AN important Minute on Indian education has been issued and a summary of it was published in the *Times* of Monday. The Minute deals with education of all grades, and with the educational needs of girls and women as well as of boys and men. Referring to university work, the State document points out that it has been realised in India that universities which are merely examining boards tend to accentuate the defects of the Indian intellect—the disproportionate development of the memory, the incapacity to observe and appreciate facts, and the taste for metaphysical distinctions. It is proposed, as a result of the recent commission, to reconstitute the unwieldy senates of the universities, to define and regulate the position and powers of the syndicates, and to extend by law to graduates the privilege of electing members of the senate. The universities will be empowered to provide teaching, while collegiate teaching will be tested not merely by examination, but by systematic inspection, and a higher educational standard will be enforced from affiliated colleges. Such colleges must have a properly constituted managing body, an adequate teaching staff, suitable buildings and equipment, students' residences, sufficient funds, and a proper scale of fees. Government is prepared to afford liberal financial aid to enable the universities and affiliated colleges to adapt themselves to these new conditions, trusting also that such aid may stimulate private beneficence. As regards Indian technical education, the Minute states it has hitherto been